CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A CMOS imaging device, comprising:

a plurality of photo diodes;

a plurality of photoconductors formed over said plurality of photo diodes, each photoconductor being capable of receiving and propagating light within an interior space of each said photoconductor to at least one of said photo diodes, said interior space defined by the outer surfaces of each said photoconductor; and

at least one fluidic material between each said photoconductor, said at least one fluidic material having a lower refractive index as compared to the refractive index of each said photoconductor.

2. The CMOS imaging device of claim 1, wherein each said photoconductor receives and propagates light to a single corresponding photo diode.

3. The CMOS imaging device of claim 1, wherein each said photoconductor comprises a material selected from the group consisting of silicon dioxide and nitride.

4. The CMOS imaging device of claim 1, wherein each said photoconductor comprises silicon dioxide and nitride.

5. The CMOS imaging device of claim 1, wherein said outer surfaces of each said photoconductor are selected from the group consisting of substantially straight, substantially diagonal and curved outer surfaces.

6. The CMOS imaging device of claim 1, wherein said at least one fluidic material is a gas.

7. The CMOS imaging device of claim 6, wherein said at least one fluidic material is air.

8. The CMOS imaging device of claim 1, wherein said at least one fluidic material comprises a non-gaseous fluid.

9. The CMOS imaging device of claim 1, wherein there is minimal space between the upper portions of each adjacent photoconductor.

10. The CMOS imaging device of claim 1, wherein the outer perimeter of an upper portion of each said photoconductor comprises at least three substantially straight edges.

11. The CMOS imaging device of claim 10, wherein said outer perimeter is selected from the group consisting of a polygonal, substantially square, substantially pentagonal, substantially hexagonal, and substantially octagonal outer perimeter.

12. The CMOS imaging device of claim 1, wherein a nitride liner is provided around an outer perimeter of each said photoconductor.

13. The CMOS imaging device of claim 1, wherein the diameter of an upper portion of each said photoconductor is greater than the diameter at the base of each respective photoconductor.

14. A CMOS imaging device, comprising:

a semiconductor substrate;

a plurality of photo diodes at or beneath an upper surface of said semiconductor substrate;

a plurality of photoconductors formed over said plurality of photo diodes, each photoconductor being capable of receiving and propagating light within an interior space of each said photoconductor to at least one of said photo diodes, said interior space defined by the outer surfaces of each said photoconductor; and

at least one fluidic material between each said photoconductor, said at least one fluidic material having a lower refractive index as compared to the refractive index of each said photoconductor.

15. An image pixel array in a CMOS imaging device, comprising:

a plurality of photoconductors formed over a plurality of photo diodes, said photo diodes formed at or beneath the upper surface of a semiconductor device, each photoconductor being capable of receiving and propagating light within an interior space of each said photoconductor to at least one of said photo diodes, said interior space defined by the outer surfaces of each said photoconductor;

a color filter formed over each said photoconductor; and

at least one fluidic material between each said photoconductor, said at least one fluidic material having a lower refractive index as compared to the refractive index of each said photoconductor.

16. The image pixel array of claim 15, wherein each said photoconductor receives and propagates light to a single corresponding photo diode.

17. The image pixel array of claim 15, wherein each said photoconductor comprises a material selected from the group consisting of silicon dioxide and nitride.

18. The image pixel array of claim 15, wherein each said photoconductor comprises silicon dioxide and nitride.

19. The image pixel array of claim 15, wherein said outer surfaces of each said photoconductor are selected from the group consisting of substantially straight, substantially diagonal and curved outer surfaces.

20. The image pixel array of claim 15, wherein said at least one fluidic material is a gas.

21. The image pixel array of claim 20, wherein said at least one fluidic material is air.

22. The image pixel array of claim 15, wherein said at least one fluidic material comprises a non-gaseous fluid.

23. The image pixel array of claim 15, wherein there is minimal space between the upper portions of each adjacent photoconductor.

24. The image pixel array of claim 15, wherein the outer perimeter of an upper portion of each said photoconductor comprises at least three substantially straight edges.

25. The image pixel array of claim 24, wherein said outer perimeter is selected from the group consisting of a polygonal, substantially square, substantially pentagonal, substantially hexagonal, and substantially octagonal outer perimeter.

26. The image pixel array of claim 15, wherein a nitride liner is provided around an outer perimeter of each said photoconductor.

27. The image pixel array of claim 15, wherein the diameter of an upper portion of each said photoconductor is greater than the diameter at the base of each respective photoconductor.

28. A method of fabricating a photoconductor array in a CMOS imaging device, comprising:

forming a plurality of photo diodes;

forming a sacrificial layer over said plurality of photo diodes;

removing at least a portion of said sacrificial layer to expose an opening over each of said photo diodes;

forming a photoconductor over each said photo diode and within said openings; and

removing said sacrificial layer surrounding each said photoconductor, wherein at least one fluidic material remains between each said photoconductor, said at least one fluidic material having a lower refractive index as compared to the refractive index of each said photoconductor.

29. The method of claim 28, wherein said sacrificial layer comprises a material selected from the group consisting of polycarbonate-based materials and polynorbornene.

30. The method of claim 29, wherein said sacrificial layer comprises a polycarbonate-based material.

31. The method of claim 29, wherein said sacrificial layer comprises polynorbornene.

32. The method of claim 28, wherein the diameter of an upper portion of each said opening formed over each said photo diode is greater than the diameter at the base of each said opening.

33. The method of claim 28, wherein each said photoconductor receives and propagates light to a single corresponding photo diode.

34. The method of claim 28, wherein each said photoconductor comprises a material selected from the group consisting of silicon dioxide and nitride.

35. The method of claim 28, wherein each said photoconductor comprises silicon dioxide and nitride.

36. The method of claim 28, wherein said outer surfaces of each said photoconductor are selected from the group consisting of substantially straight, substantially diagonal and curved outer surfaces.

37. The method of claim 28, wherein said at least one fluidic material is a gas.

38. The method of claim 37, wherein said at least one fluidic material is air.

39. The method of claim 28, wherein said at least one fluidic material comprises a non-gaseous fluid.

40. The method of claim 28, wherein there is minimal space between the upper portions of each adjacent photoconductor.

41. The method of claim 28, wherein the outer perimeter of an upper portion of each said photoconductor comprises at least three substantially straight edges.

42. The method of claim 41, wherein said outer perimeter is selected from the group consisting of a polygonal, substantially square, substantially pentagonal, substantially hexagonal, and substantially octagonal outer perimeter.

43. The method of claim 28, wherein a nitride liner is provided around an outer perimeter of each said photoconductor.

44. The method of claim 28, wherein the diameter of an upper portion of each said photoconductor is greater than the diameter at the base of each respective photoconductor.

45. The method of claim 28, wherein said photoconductive layer comprises a material selected from the group consisting of silicon dioxide and nitride.

46. The method of claim 28, wherein said photoconductive layer comprises silicon dioxide and nitride.

47. The method of claim 28, wherein removing said sacrificial layer comprises decomposing said sacrificial material by heating to produce volatile products removable by evaporation and diffusion.

48. The method of claim 47, wherein said decomposing comprises heating said sacrificial material in the range of about 125° C to about 200° C.

49. The method of claim 48, wherein said heating said sacrificial material is performed at about 125° C.

50. The method of claim 48, wherein said heating said sacrificial material is performed at about 200° C.

51. The method of claim 28, wherein a nitride liner is provided around each of said photoconductors to prevent diffusion of impurities from said color filter layer into said semiconductor substrate.

52. A method of transmitting light to a photo diode in a CMOS imaging device, comprising:

forming a plurality of photoconductors over a plurality of photo diodes in said CMOS imaging device;

forming a color filter layer wherein an individual color filter is formed over each said photo diode;

forming at least one fluidic material between each of said photoconductors, said at least one fluidic material having a refractive index lower than the refractive index of each of said photoconductors; and

exposing light to said plurality of photoconductors, wherein said refractive index of each said photoconductor operates to propagate the light within an interior space of each said photoconductor to at least one of said photo diodes, said interior space defined by the outer surfaces of each said photoconductor.

53. The method of claim 52, wherein each said photoconductor receives and propagates light to a single corresponding photo diode.

54. The method of claim 52, wherein each said photoconductor comprises a material selected from the group consisting of silicon dioxide and nitride.

55. The method of claim 52, wherein each said photoconductor comprises silicon dioxide and nitride.

56. The method of claim 52, wherein the outer surfaces of each said photoconductor are selected from the group consisting of substantially straight, substantially diagonal and curved outer surfaces.

57. The method of claim 52, wherein said at least one fluidic material is a gas.

58. The method of claim 57, wherein said at least one fluidic material is air.

59. The method of claim 52, wherein said at least one fluidic material comprises a non-gaseous fluid.

60. The method of claim 52, wherein the outer perimeter of an upper portion of each said photoconductor comprises at least three substantially straight edges.

61. The method of claim 52, wherein said outer perimeter is selected from the group consisting of a polygonal, substantially square, substantially pentagonal, substantially hexagonal, and substantially octagonal outer perimeter.

62. The method of claim 52, wherein a nitride liner is provided around an outer perimeter of each said photoconductor.

63. A CMOS imager system, comprising:

(i) a processor; and

(ii) a CMOS imaging device coupled to said processor, said CMOS imaging device comprising:

a semiconductor substrate;

a plurality of photo diodes at or beneath an upper surface of said semiconductor substrate;

a plurality of photoconductors formed over said plurality of photo diodes, each photoconductor being capable of receiving and propagating light within an interior space of each said photoconductor to at least one of said photo diodes, said interior space defined by the outer surfaces of each said photoconductor;

a color filter formed over each said photoconductor; and

at least one fluidic material between each said photoconductor, said at least one fluidic material having a lower refractive index as compared to the refractive index of each said photoconductor.

64. The CMOS imager system of claim 63, wherein each said photoconductor receives and propagates light to a single corresponding photo diode.

65. The CMOS imager system of claim 63, wherein each said photoconductor comprises a material selected from the group consisting of silicon dioxide and nitride.

66. The CMOS imager system of claim 63, wherein each said photoconductor comprises silicon dioxide and nitride.

67. The CMOS imager system of claim 63, wherein the outer surfaces of each said photoconductor are selected from the group consisting of substantially straight, substantially diagonal and curved outer surfaces.

68. The CMOS imager system of claim 63, wherein said at least one fluidic material is a gas.

69. The CMOS imager system of claim 68, wherein said at least one fluidic material is air.

70. The CMOS imager system of claim 63, wherein said at least one fluidic material comprises a non-gaseous fluid.

71. The CMOS imager system of claim 63, wherein there is minimal space between the upper portions of each adjacent photoconductor.

72. The CMOS imager system of claim 63, wherein the outer perimeter of an upper portion of each said photoconductor comprises at least three substantially straight edges.

73. The CMOS imager system of claim 72, wherein said outer perimeter is selected from the group consisting of a polygonal, substantially square, substantially pentagonal, substantially hexagonal, and substantially octagonal outer perimeter.

74. The CMOS imager system of claim 63, wherein a nitride liner is provided around an outer perimeter of each said photoconductor.

75. The CMOS imager system of claim 63, wherein the diameter of an upper portion of each said photoconductor is greater than the diameter at the base of each respective photoconductor.